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March 2, 2000

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MAR 02 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

By Messenger

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S.W., TW-A325
Washington, D.C. 20554

Re: **EX PARTE**
ET Docket 95-18; IB Docket 99-81; RM-9328

Dear Ms. Salas:

The attached letters were delivered today by hand to Chairman Kennard and Commissioners Ness, Tristani, Furchtgott-Roth and Powell. Copies were also delivered to Ari Fitzgerald, Mark Schneider, Adam Krinsky, Bryan Tramont and Peter Tenhula, legal advisors, respectively, to each of the Commissioners.

Pursuant to Section 1.1206(b)(1) of the Commission's rules, an original and five copies of this letter are provided to the Secretary for inclusion in the record in the above-captioned proceedings.

Very truly yours,

Cheryl A. Tritt

Cheryl A.Tritt
Counsel to ICO Global Communications

cc: Dale Hatfield (w/attachments)
Julius Knapp (w/attachments)
Rebecca Dorch (w/attachments)
Sean White (w/attachments)
Linda Haller (w/attachments)
Fern Jarmulnek (w/attachments)

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Howard Griboff (w/attachments)
Cassandra Thomas (w/attachments)
Christopher Murphy (w/attachments)
Karl Kensinger (w/attachments)
Alex Roytblat (w/attachments)

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March 2, 2000

Chairman William E. Kennard
Federal Communications Commission
The Portals
445 12th Street, S.W., Room 8-B201
Washington, D.C. 20554

Re: **EX PARTE**
IB Docket No. 99-81; ET Docket No. 95-18, RM-9328

Dear Chairman Kennard:

As the Commission previously has been advised, the United States Bankruptcy Court for the District of Delaware granted final approval to an agreement reached on October 31, 1999 (the "Agreement") under which Craig McCaw and his affiliated companies, Teledesic LLC and Eagle River Investments LLC, will provide a total investment of up to $1.2 billion to fund the planned build-out of the ICO mobile satellite service ("MSS") system and provide working capital through the launch of ICO's MSS satellites.[1] In the process of bankruptcy restructuring, ICO and Eagle River have determined that a broader range of services and technological applications will be essential to the success of the ICO MSS system. Specifically, the addition of a set of high-quality wireless data applications that will be accessible through ICO customers' handsets is critical to ensuring that satellite service is a viable commercial service and quite possibly the only alternative communication system for rural and other unserved areas.

Unfortunately, as the attached analysis illustrates, the addition of the new data services to the ICO system will further constrain that system's ability to share with terrestrial Fixed Service (FS) incumbents in the 2 GHz MSS downlink band. As the attached technical analysis demonstrates, whenever an ICO user terminal (UT) is within

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the radio horizon of an FS transmitter, the UT will be unable to operate on the frequencies occupied by the local FS transmitter. The new data service requires the use of wider signals and lower error rates, making the ICO system less tolerant of interference from terrestrial Fixed Service ("FS") systems and less able to avoid such interference. Specifically, techniques that could be applied to reduce the probability that a voice channel assigned to a UT would overlap the frequencies used by local FS microwave transmitters, become increasingly less effective as higher bandwidth services become predominate. Moreover, data services will load the ICO system's capacity more rapidly than voice service and will prevent ICO from reserving alternative, interference-free frequencies required to allow sharing with FS incumbents. Accordingly, in order for ICO to meet anticipated demand for its wireless mobile wideband data service at an acceptable level of quality, additional clearing will be required in the downlink and will be substantially in excess of the estimates the Commission has made so far.

ICO and Eagle River note that it is the present policy of the FCC to require 2 GHz MSS systems to compensate terrestrial incumbents for relocation costs in order to ameliorate any operational disruption or financial hardship. However, ICO has consistently maintained, even under its more modest plan for voice services, that unreasonable compensation measures for relocating terrestrial incumbents would impair the ability of 2 GHz MSS systems to move forward. For example, as ICO pointed out in a recent presentation to the Commission, $200 million of relocation costs imposed upon MSS providers in the U.S. likely would increase the per-minute cost of 2 GHz MSS service by 83 cents.[2] Certainly the need to reflect these substantial added costs in end-user rates will seriously affect the ability of ICO to reach its primary market, customers in unserved and underserved areas of the United States.

ICO and Eagle River are committed to meeting the Commission's stated goal of providing affordable service to unserved and underserved areas of the United States. Consumers in rural and remote areas are a primary market for 2 GHz MSS voice and data services. Indeed, it is Commission policy that satellite services - as distinct from terrestrial wireless services - focus on rural areas. Consequently, the Commission must not reflexively adopt the relocation compensation scheme developed for a terrestrial service like PCS in all its particulars. Instead, the Commission must apply the

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Unlike PCS, where remote and rural areas can be - and are in fact - ignored, satellite services must incur the costs to serve those areas. This includes, of course, the costs of clearing incumbents. Terrestrial services can simply choose not to clear incumbents from low-density areas. Satellite services, because they are designed to offer service everywhere, cannot. Thus the PCS relocation regime may be sustainable for PCS because relocation need only be paid for in high-density areas where the high volume of traffic can support the high costs of relocating the incumbents. It is not sustainable, however, for MSS because rural and remote users are not able to support the high cost of relocation. Application of the Commission's PCS reallocation rules to satellite services undermines the Commissions own policy goals for satellite services - by making deployment in rural and underserved areas cost-inefficient.

There are, of course, other reasons why an unreasonably costly relocation scheme is bad public policy -- not least of which is the fact that it would constitute a windfall to FS operators. At the extreme, such a significant relocation cost burden might actually prevent the ICO system from deploying at all.

Under these circumstances, it is important for the Commission to adhere to its stated policy goal of leaving incumbents no worse off, but also no better off, than before any relocation. As ICO has previously argued, this can be achieved by measuring relocation compensation according to the remaining useful life of the equipment that is being replaced – not the full replacement cost of brand new equipment. After all, replacement cost is the measure of how much it costs for the incumbent to operate for the *next* ten years. What the incumbent should be compensated for is the extent to which the relocation made it impossible to recover the initial investment in the equipment that is being replaced – *i.e.*, a value based on the remaining useful life of the equipment at the time it was taken out of service (for which the book value of the equipment would be a reasonable surrogate number). While this measure of relocation compensation might require the incumbent to make a capital investment that is somewhat greater than the amount received from the new entrant, that incremental capital investment would reflect the fact that the new equipment would be in many ways superior to the old equipment – with a longer expected useful life or greater functionality, for example.

ICO and Eagle River understand that resistance from terrestrial incumbents has left the Commission with an unpalatable choice between two measures of relocation

compensation – one of them efficient but unpopular with incumbents, and the other one charitable to incumbents, but so inefficient as to jeopardize the viability of the MSS industry. With the increased importance of data services to MSS network viability, the need to find an equitable and efficient resolution has become even more urgent. We look forward to working with the Commission and its staff to find ways in which the terrestrial relocation framework can be modified so as to permit the successful roll-out of MSS services to the many, many places within the United States that still lack any mobile voice service.

ICO and Eagle River appreciate the Commission's efforts to accommodate the competing concerns that the 2 GHz MSS relocation cost issue presents. ICO and Eagle River also recognize that the information in this letter comes late in the Commission's 2 GHz MSS proceeding. For these reasons, ICO and Eagle River wished to bring these developments to the Commission's attention as soon as possible, in the hope that the Commission's ongoing consideration of the relocation cost problem will take them into account.

Respectfully submitted,

R. Gerard Salemme
Eagle River Investments, ~~L.L.C.~~

Cheryl A. Tritt
Counsel to ICO Global Communications

Attachment

cc: Ari Fitzgerald

FS Interference Into ICO User Terminals at 2 GHz

Introduction

This report presents an analysis relating to terrestrial Fixed Service (FS) systems and ICO NGSO/MSS co-frequency operation in the 2-GHz downlink band (2170 - 2200 MHz). The results indicate that whenever an ICO user terminal (UT) is within the radio horizon of an FS transmitter, unacceptable interference levels will preclude that portion of frequency spectrum from ICO use.

The focus on improved *data* communications services by ICO means a different approach to sharing in the downlink with the FS. Data transmissions require the use of wider signals and significantly lower bit error rates, making the system less tolerant of FS interference, and less able to avoid it. The original concept for FS sharing was to carry alternative frequencies, one of which should be interference-free. Since satellite loading and spectrum uptake will increase faster with data than with a voice-oriented service, there will be reduced satellite resources that can be used to carry alternative frequencies for interference avoidance. ICO will be one of the main sources of wireless mobile wideband data, and users will expect a high quality of service in any location. This will require additional clearing in the 2 GHz downlink band, as high levels of interference will occur in the proximity (frequency and distance) of any FS transmitter.

Interference Scenario

Figure 1depicts the geometry associated with the FS interfering directly into the ICO UT. The magnitude of interference will be related to the distance from the FS transmitter and the angular separation from the FS antenna boresight. By specifying an external interference allowance threshold, a boundary can be generated around the FS transmitter identifying a "keep-out" zone (a.k.a. exclusion zone).

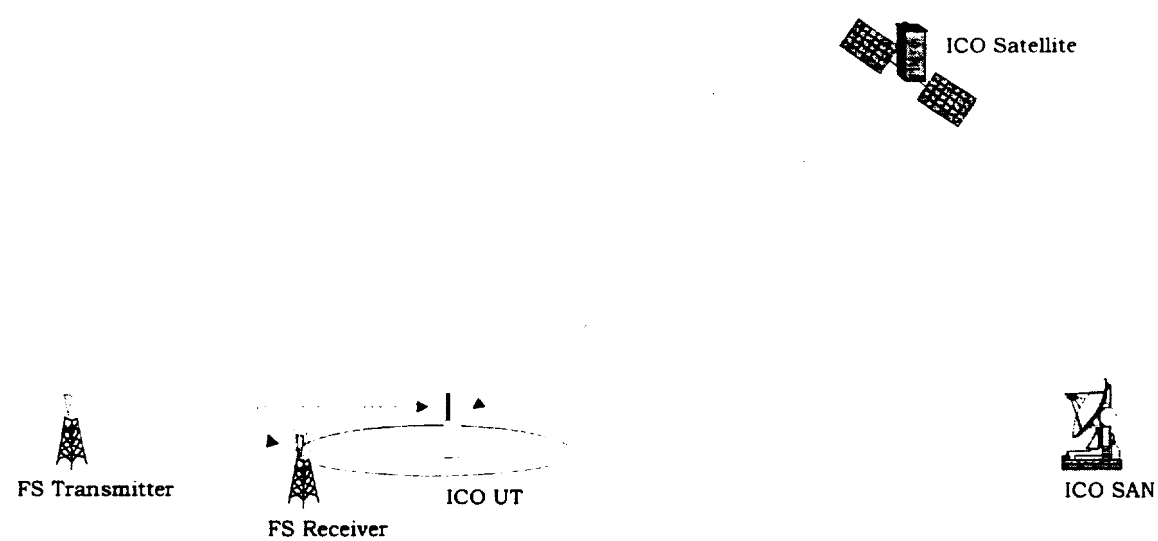

Figure 1. FS Interference into ICO UT (2170-2200 MHz Frequency Band)

Separation distances that would be required for the protection of an ICO user terminal (UT) from terrestrial station are given in Figure 2. In this analysis, parameters from the twenty-four 1.7-2.45 GHz FS systems summarized in Recommendation ITU-R F.758-1 were used. These parameters, which are provided in Appendix A, represent three types of FS systems - traditional point-to-point, land-mobile and troposcatter. For each of the 24 carriers, two distances are computed: one assuming that the interference to the UT should not exceed 6% long-term allowance (1 dB) and the other assuming that the interference can degrade the link margin by 10 dB. Again note that the UT is assumed to be located in the back-lobe of the terrestrial station. As shown in the figure, the majority of typical FS systems will create a minimum separation distance on the order of 60- to 200-km. Although such line-of-sight distances are unlikely to occur due to terrain blockages, it is clear that whenever the ICO UT sees an FS transmitter (independent of FS pointing direction), the UT will not be able to operate in the same frequency band.

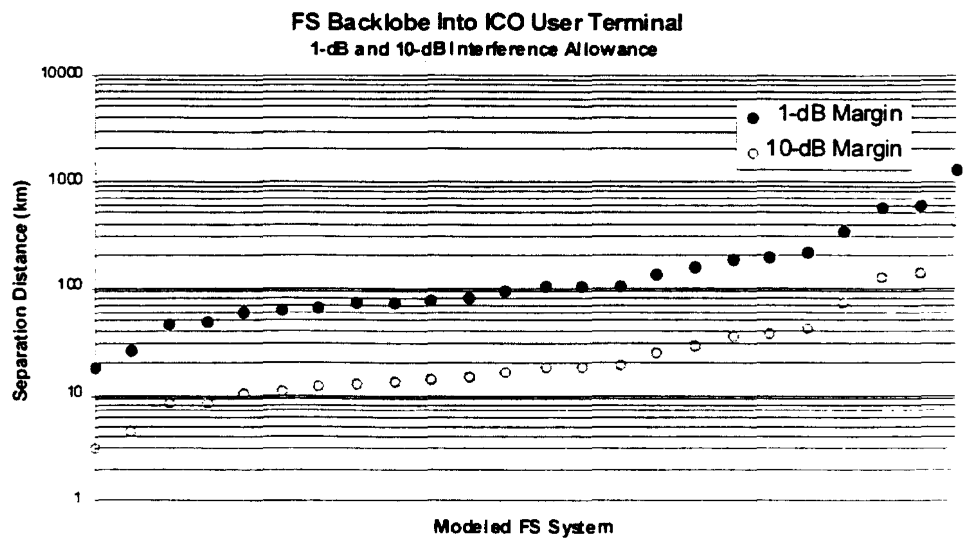

Figure 2. Separation Distances Required for the Protection of an ICO UT located in the Back-lobe of the Transmit Antenna of a Terrestrial Station.

A. FS System Parameters

Appendix A

FS System Parameters for FS Sharing Below 3 GHz (Rec. ITU-R F.758-1, Table 6)

Frequency band GHz)	1.7-2.45																			
Modulation	FM-TVOB	FM-FDM	FM-MLT-PT		FM-TV	FM-FDM	FM-FDM tropos	4-PSK tropos	4-PSK	4-PSK	FM-FDM	4-PSK	4-PSK	FM-FDM	4-PSK	FM-QAM	9-QRP	0-QPSK	4-PSK	4-PSK
Capacity	625-line PAL	60-132 channels	94 channels		625-line PAL	960 channels	72-312 channels	2 Mbit/s	34 Mbit/s	8 Mbit/s	1-6 channels	48 channels	12.6 Mbit/s	600 channels	2 × 8 Mbit/s	1 TV + 2 Mbit/s	4 × 1.54 Mbit/s	45 Mbit/s	8 Mbit/s	2 × 8 Mbit/s
Channel spacing (MHz)	Variable	14/1	3.5		29	29	Special	Special	29	14	0.4	2.5	28	28	14	3.5	3.5	29	7	14
			CS	OS																
Antenna gain (maximum) (dBi)	25	31	10	19	34	34	49	45	31	30	25	29	30	35.7	28	32	32	33	28	28
Feeder/multiplexer loss (minimum) (dB)	0	5	3	3	5	3	2	2	1	3	3	6	3.5	3.5	4	6	3	3	5	5
Antenna type	1.2 m dish	2.4 m dish	Omni	Horn	3.7 m dish	3.7 m dish	12 m dish	9 m dish	1.8 m dish	1.2 m dish	Yagi	Dish	Dish	Dish	2.4 m dish	3 m dish	3 m dish	3 m dish	1.8 m dish	1.8 m dish
Maximum Tx output power (dBW)	7	7	4	4	10	7	28	30	3	0	10	-9	-10	-5.2	3	5	6	7	7	-3
e.i.r.p. (maximum) (dBW)	32	33	13	22	39	38	75	73	34	30	32	14	16.5	27	29	37	38	40	20	23
Receiver IF bandwidth (MHz)	30	2.8	2	2	40	40	6	1	20	4	0.15	1.5	6.5	20	8	3	3.5	29	3	4.6
Receiver noise figure (dB)	8	7	9	9	10	10	2	4	4	5	4	6	9	10	4	4	5	4	4	4
Receiver thermal noise (dBW)	-121	-133	-132	-132	-118	-118	-132	-140	-127	-133	-148	–	–	–	-131	-135	-133	-125	-135	-133
Nominal Rx input level (dBW)	-65	-79	-97	-97	-68	-64	–	–	-73	-78	-78	-78	-88.3	-78			-70	-75	-83	-83
Rx input level for 1 × 10^{-3} BER (dBW)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	131	-113	-118	N/A		–	N/A			-117	-112	-123	-123
Nominal short-term interference (dBW) (% time)																				
Nominal long-term interference (dBW)	-127	-143	-142	-142	-128	-129	-138	146	137	-143	-158				-137	-141	-139	-135	-141	-139
Equivalent power (dB(W/4 kHz))	–	-172	-169	-169	–	-169	-172	–	–	–	-174				-170	-170	-168	-174	–	–
Spectral density (dB(W/MHz))	-142	–	–	–	-144	–	–	146	150	-149	–	–			-146	–			-146	-146
Refer to Notes	(1), (4)	(2), (5)	(2), (5)	(2), (5)	(2), (4)	(2), (5)	(1), (5)	(1), (4)	(2), (4)	(2), (4)	(2), (5)	(3), (4)	(3), (4)	(3), (5)	(1), (4)		(1)	(1)	(1)	(1)

TVOB: temporary TV outside broadcast (ENG) link — OS: out station

CS: central station — N/A: not applicable

(1) Specified interference will reduce system C/N by 1 dB (interference 6 dB below receiver thermal noise floor).

(2) Specified interference will reduce system C/N by 0.5 dB (interference 10 dB below receiver thermal noise floor).

(3) Specified interference will have a relative contribution of no more than 10% of total noise.

(4) The specified interference level is total power within the receiver bandwidth.

(5) The specified interference level should be divided by the receiver bandwidth to obtain an average spectral density. The interference spectral density, averaged over any 4 kHz within the receiver bandwidth, must not exceed this value.

FS System Parameters for FS Sharing Below 3 GHz (Rec. ITU-R F.758-1, Table 7)

Frequency band (GHz)	1.7-2.45				2.1-2.2						2.45-2.69				
Modulation	4-PSK		64-QAM	256-QAM	FDM-FM	FDM-FM	FDM-FM	32 TCM	64-QAM	256-QAM	FM-FDM tropos	MSK	4-PSK	4-PSK	FM-TVOB
Capacity			45 Mbit/s	18.5 Mbit/s	48 channels	96 channels	252 channels	3.1 Mbit/s	6.2 Mbit/s	18.5 Mbit/s	17-312 channels	2 × 2 Mbit/s	34 Mbit/s	2.3 Mbit/s	625-line PAL
Channel spacing (MHz)	3.5		10	3.5	0.8	1.6	3.5	0.8	1.6	3.5	Special	14			Variable
	CS	OS													
Antenna gain (maximum) (dBi)	17	27	33	33	38	38	38	38	38	38	49	25	35.4		18
Feeder/multiplexer loss (minimum) (dB)	0	0	2	2	0	0	0	0	0	0	2	4			1
Antenna type	Omni/ section	Dish/horn	Dish	Dish	Dish	Dish	Dish	Dish	Dish	Dish	12 m dish	1.2 m dish	3 m dish	Yagi	Dish
Maximum Tx output power (dBW)	7	7	1	−1	+8	+8	+8	+2	+5	+2	28	5	−2		7
e.i.r.p. (maximum) (dBW)	24	34	34	32	46	46	46	40	43	40	75	26	33		32
Receiver IF bandwidth (MHz)	3.5	3.5	10	3.5	2.5	6.0	12.0	0.8	1.6	3.5	6	3			30
Receiver noise figure (dB)	3.5	3.5	4	4	5	5	5	3	3	3	2	4			6
Receiver thermal noise (dBW)	−135	−135	−130	−134.5	−140	−137	−134	−142	−139	−136	−132	−135			−123
Nominal Rx input level (dBW)	–	–	−65	−65	−60	−60	−60	−60	−60	−60	−65	–			−55
Rx input level for 1×10^{-3} BER (dBW)	–	–	−106	−104.5	−121	−118	−114	−117	−115	−105	N/A	–			N/A
Nominal short-term interference (dBW) (% time)															
Nominal long-term interference (dBW)	−141	−141	−136	−140.5	−150	−147	−144	−152	−149	−146	−138	−141	−111.5		−123
Equivalent power (dB(W/4 kHz))	−170	−170	−170	−170	−173	−173	−173				−172	−170			–
Spectral density (dB(W/MHz))	–	–	−146	−146				−151	−151	−151	–	−162			−129
Refer to Notes	(1)	(1)			(2), (4), (5)	(2), (4), (5)	(2), (4), (5)	(2), (4)	(2), (4)	(2), (4)	(1), (5)				

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Commissioner Susan Ness
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Unfortunately, as the attached analysis illustrates, the addition of the new data services to the ICO system will further constrain that system's ability to share with terrestrial Fixed Service (FS) incumbents in the 2 GHz MSS downlink band. As the attached technical analysis demonstrates, whenever an ICO user terminal (UT) is within

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Counsel to ICO Global Communications

Attachment

cc: Mark Schneider

FS Interference Into ICO User Terminals at 2 GHz

Introduction

This report presents an analysis relating to terrestrial Fixed Service (FS) systems and ICO NGSO/MSS co-frequency operation in the 2-GHz downlink band (2170 – 2200 MHz). The results indicate that whenever an ICO user terminal (UT) is within the radio horizon of an FS transmitter, unacceptable interference levels will preclude that portion of frequency spectrum from ICO use.

The focus on improved *data* communications services by ICO means a different approach to sharing in the downlink with the FS. Data transmissions require the use of wider signals and significantly lower bit error rates, making the system less tolerant of FS interference, and less able to avoid it. The original concept for FS sharing was to carry alternative frequencies, one of which should be interference-free. Since satellite loading and spectrum uptake will increase faster with data than with a voice-oriented service, there will be reduced satellite resources that can be used to carry alternative frequencies for interference avoidance. ICO will be one of the main sources of wireless mobile wideband data, and users will expect a high quality of service in any location. This will require additional clearing in the 2 GHz downlink band, as high levels of interference will occur in the proximity (frequency and distance) of any FS transmitter.

Interference Scenario

Figure 1depicts the geometry associated with the FS interfering directly into the ICO UT. The magnitude of interference will be related to the distance from the FS transmitter and the angular separation from the FS antenna boresight. By specifying an external interference allowance threshold, a boundary can be generated around the FS transmitter identifying a "keep-out" zone (a.k.a. exclusion zone).

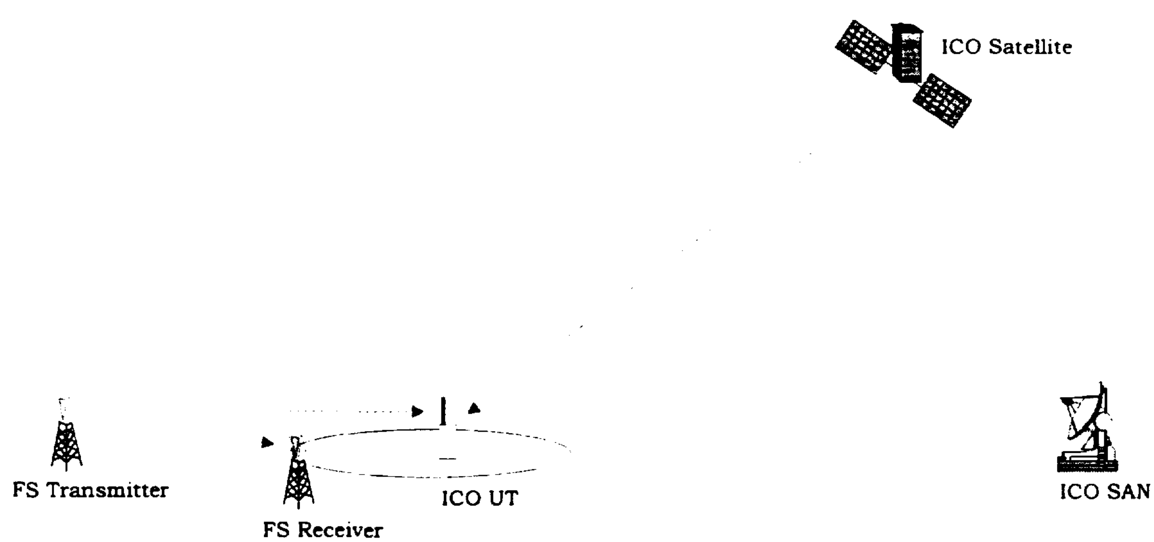

Figure 1. FS Interference into ICO UT (2170-2200 MHz Frequency Band)

Separation distances that would be required for the protection of an ICO user terminal (UT) from terrestrial station are given in Figure 2. In this analysis, parameters from the twenty-four 1.7-2.45 GHz FS systems summarized in Recommendation ITU-R F.758-1 were used. These parameters, which are provided in Appendix A, represent three types of FS systems - traditional point-to-point, land-mobile and troposcatter. For each of the 24 carriers, two distances are computed: one assuming that the interference to the UT should not exceed 6% long-term allowance (1 dB) and the other assuming that the interference can degrade the link margin by 10 dB. Again note that the UT is assumed to be located in the back-lobe of the terrestrial station. As shown in the figure, the majority of typical FS systems will create a minimum separation distance on the order of 60- to 200-km. Although such line-of-sight distances are unlikely to occur due to terrain blockages, it is clear that whenever the ICO UT sees an FS transmitter (independent of FS pointing direction), the UT will not be able to operate in the same frequency band.

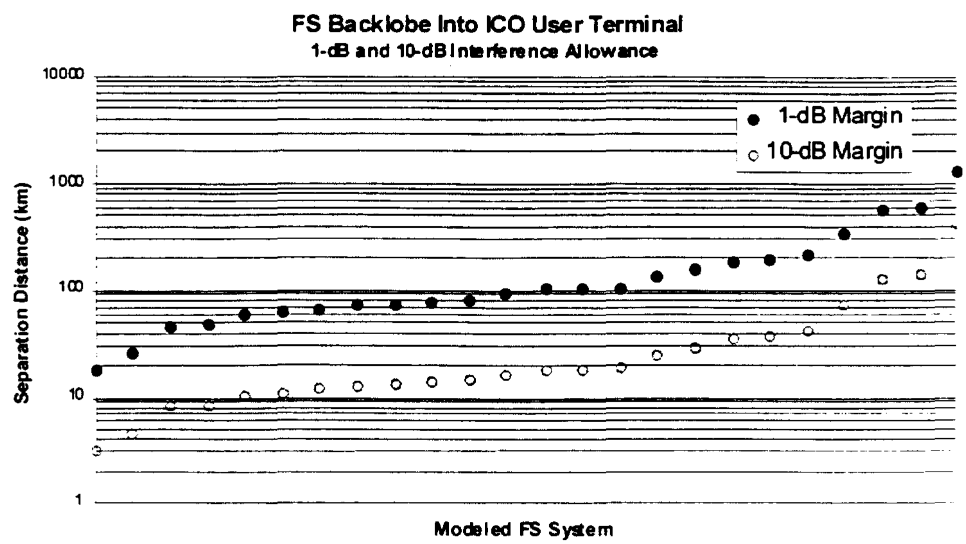

Figure 2. Separation Distances Required for the Protection of an ICO UT located in the Back-lobe of the Transmit Antenna of a Terrestrial Station.

A. FS System Parameters

Appendix A

FS System Parameters for FS Sharing Below 3 GHz (Rec. ITU-R F.758-1, Table 6)

Frequency band GHz)	1.7-2.45																			
Modulation	FM-TVOB	FM-FDM	FM-MLT-PT		FM-TV	FM-FDM	FM-FDM tropos	4-PSK tropos	4-PSK	4-PSK	FM-FDM	4-PSK	4-PSK	FM-FDM	4-PSK	FM-QAM	9-QRP	0-QPSK	4-PSK	4-PSK
Capacity	625-line PAL	60-132 channels	94 channels		625-line PAL	960 channels	72-312 channels	2 Mbit/s	34 Mbit/s	8 Mbit/s	1-6 channels	48 channels	12.6 Mbit/s	600 channels	2 × 8 Mbit/s	1 TV + 2 Mbit/s	4 × 1.54 Mbit/s	45 Mbit/s	8 Mbit/s	2 × 8 Mbit/s
Channel spacing (MHz)	Variable	14/1	3.5		29	29	Special	Special	29	14	0.4	2.5	28	28	14	3.5	3.5	29	7	14
			CS	OS																
Antenna gain (maximum) (dBi)	25	31	10	19	34	34	49	45	31	30	25	29	30	35.7	28	32	32	33	28	28
Feeder/multiplexer loss (minimum) (dB)	0	5	3	3	5	3	2	2	1	3	3	6	3.5	3.5	4	6	3	3	5	5
Antenna type	1.2 m dish	2.4 m dish	Omni	Horn	3.7 m dish	3.7 m dish	12 m dish	9 m dish	1.8 m dish	1.2 m dish	Yagi	Dish	Dish	Dish	2.4 m dish	3 m dish	3 m dish	3 m dish	1.8 m dish	1.8 m dish
Maximum Tx output power (dBW)	7	7	4	4	10	7	28	30	3	0	10	-9	-10	-5.2	3	5	6	7	7	-3
e.i.r.p. (maximum) (dBW)	32	33	13	22	39	38	75	73	34	30	32	14	16.5	27	29	37	38	40	20	23
Receiver IF bandwidth (MHz)	30	2.8	2	2	40	40	6	1	20	4	0.15	1.5	6.5	20	8	3	3.5	29	3	4.6
Receiver noise figure (dB)	8	7	9	9	10	10	2	4	4	5	4	6	9	10	4	4	5	4	4	4
Receiver thermal noise (dBW)	-121	-133	-132	-132	-118	-118	-132	-140	-127	-133	-148	–	–	–	-131	-135	-133	-125	-135	-133
Nominal Rx input level (dBW)	-65	-79	-97	-97	-68	-64	–	-	-73	-78	-78	-78	-88.3	-78			-70	-75	-83	-83
Rx input level for 1×10^{-3} BER (dBW)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-131	-113	-118	N/A	-	-	N/A			-117	-112	-123	-123
Nominal short-term interference (dBW) (% time)																				
Nominal long-term interference (dBW)	-127	-143	-142	-142	-128	-129	-138	-146	-137	-143	-158				-137	-141	-139	-135	-141	-139
Equivalent power (dB(W/4 kHz))	–	-172	-169	-169	–	-169	-172	–	–	–	-174				-170	-170	-168	-174	–	–
Spectral density (dB(W/MHz))	-142	-	–	–	-144	–	–	-146	-150	-149	–	–			-146	–			-146	-146
Refer to Notes	(1), (4)	(2), (5)	(2), (5)	(2), (5)	(2), (4)	(2), (5)	(1), (5)	(1), (4)	(2), (4)	(2), (4)	(2), (5)	(3), (4)	(3), (4)	(3), (5)	(1), (4)		(1)	(1)	(1)	(1)

TVOB: temporary TV outside broadcast (ENG) link   OS: out station

CS: central station   N/A: not applicable

(1) Specified interference will reduce system C/N by 1 dB (interference 6 dB below receiver thermal noise floor).

(2) Specified interference will reduce system C/N by 0.5 dB (interference 10 dB below receiver thermal noise floor).

(3) Specified interference will have a relative contribution of no more than 10% of total noise.

(4) The specified interference level is total power within the receiver bandwidth.

(5) The specified interference level should be divided by the receiver bandwidth to obtain an average spectral density. The interference spectral density, averaged over any 4 kHz within the receiver bandwidth, must not exceed this value.

FS System Parameters for FS Sharing Below 3 GHz (Rec. ITU-R F.758-1, Table 7)

Frequency band (GHz)	1.7-2.45				2.1-2.2						2.45-2.69				
Modulation	4-PSK		64-QAM	256-QAM	FDM-FM	FDM-FM	FDM-FM	32 TCM	64-QAM	256-QAM	FM-FDM tropos	MSK	4-PSK	4-PSK	FM-TVOB
Capacity			45 Mbit/s	18.5 Mbit/s	48 channels	96 channels	252 channels	3.1 Mbit/s	6.2 Mbit/s	18.5 Mbit/s	17-312 channels	2 × 2 Mbit/s	34 Mbit/s	2.3 Mbit/s	625-line PAL
Channel spacing (MHz)	3.5		10	3.5	0.8	1.6	3.5	0.8	1.6	3.5	Special	14			Variable
	CS	OS													
Antenna gain (maximum) (dBi)	17	27	33	33	38	38	38	38	38	38	49	25	35.4		18
Feeder/multiplexer loss (minimum) (dB)	0	0	2	2	0	0	0	0	0	0	2	4			1
Antenna type	Omni/ section	Dish/horn	Dish	Dish	Dish	Dish	Dish	Dish	Dish	Dish	12 m dish	1.2 m dish	3 m dish	Yagi	Dish
Maximum Tx output power (dBW)	7	7	1	−1	+8	+8	+8	+2	+5	+2	28	5	−2		7
e.i.r.p. (maximum) (dBW)	24	34	34	32	46	46	46	40	43	40	75	26	33		32
Receiver IF bandwidth (MHz)	3.5	3.5	10	3.5	2.5	6.0	12.0	0.8	1.6	3.5	6	3			30
Receiver noise figure (dB)	3.5	3.5	4	4	5	5	5	3	3	3	2	4			6
Receiver thermal noise (dBW)	−135	−135	−130	−134.5	−140	−137	−134	−142	−139	−136	−132	−135			−123
Nominal Rx input level (dBW)	–	–	−65	−65	−60	−60	−60	−60	−60	−60	−65	–			−55
Rx input level for 1×10^{-3} BER (dBW)	–	–	−106	−104.5	−121	−118	−114	−117	−115	−105	N/A	–			N/A
Nominal short-term interference (dBW) (% time)															
Nominal long-term interference (dBW)	−141	−141	−136	−140.5	−150	−147	−144	−152	−149	−146	−138	−141	−111.5		−123
Equivalent power (dB(W/4 kHz))	−170	−170	−170	−170	−173	−173	−173				−172	−170			–
Spectral density (dB(W/MHz))	–	–	−146	−146				−151	−151	−151	–	−162			−129
Refer to Notes	(1)	(1)			(2), (4), (5)	(2), (4), (5)	(2), (4), (5)	(2), (4)	(2), (4)	(2), (4)	(1), (5)				

CS: central station
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March 2, 2000

Commissioner Gloria Tristani
Federal Communications Commission
The Portals
445 12th Street, S.W., Room 8-C302
Washington, D.C. 20554

Re: **EX PARTE**
IB Docket No. 99-81; ET Docket No. 95-18, RM-9328

Dear Commissioner Tristani:

As the Commission previously has been advised, the United States Bankruptcy Court for the District of Delaware granted final approval to an agreement reached on October 31, 1999 (the "Agreement") under which Craig McCaw and his affiliated companies, Teledesic LLC and Eagle River Investments LLC, will provide a total investment of up to $1.2 billion to fund the planned build-out of the ICO mobile satellite service ("MSS") system and provide working capital through the launch of ICO's MSS satellites.[1] In the process of bankruptcy restructuring, ICO and Eagle River have determined that a broader range of services and technological applications will be essential to the success of the ICO MSS system. Specifically, the addition of a set of high-quality wireless data applications that will be accessible through ICO customers' handsets is critical to ensuring that satellite service is a viable commercial service and quite possibly the only alternative communication system for rural and other unserved areas.

Unfortunately, as the attached analysis illustrates, the addition of the new data services to the ICO system will further constrain that system's ability to share with terrestrial Fixed Service (FS) incumbents in the 2 GHz MSS downlink band. As the attached technical analysis demonstrates, whenever an ICO user terminal (UT) is within

[1] *See* letter from Cheryl A. Tritt, Esq. to Magalie Roman Salas, File No. 188-SAT-L0I-97 (Jan. 27, 2000); letter from Cheryl A. Tritt, Esq. to Magalie Roman Salas, File No. 188-SAT-L0I-97 (Sep. 27, 1999). "ICO" refers to ICO Services Limited, a wholly-owned subsidiary of ICO Global Communications (Holdings) Limited.

the radio horizon of an FS transmitter, the UT will be unable to operate on the frequencies occupied by the local FS transmitter. The new data service requires the use of wider signals and lower error rates, making the ICO system less tolerant of interference from terrestrial Fixed Service ("FS") systems and less able to avoid such interference. Specifically, techniques that could be applied to reduce the probability that a voice channel assigned to a UT would overlap the frequencies used by local FS microwave transmitters, become increasingly less effective as higher bandwidth services become predominate. Moreover, data services will load the ICO system's capacity more rapidly than voice service and will prevent ICO from reserving alternative, interference-free frequencies required to allow sharing with FS incumbents. Accordingly, in order for ICO to meet anticipated demand for its wireless mobile wideband data service at an acceptable level of quality, additional clearing will be required in the downlink and will be substantially in excess of the estimates the Commission has made so far.

ICO and Eagle River note that it is the present policy of the FCC to require 2 GHz MSS systems to compensate terrestrial incumbents for relocation costs in order to ameliorate any operational disruption or financial hardship. However, ICO has consistently maintained, even under its more modest plan for voice services, that unreasonable compensation measures for relocating terrestrial incumbents would impair the ability of 2 GHz MSS systems to move forward. For example, as ICO pointed out in a recent presentation to the Commission, $200 million of relocation costs imposed upon MSS providers in the U.S. likely would increase the per-minute cost of 2 GHz MSS service by 83 cents.[2] Certainly the need to reflect these substantial added costs in end-user rates will seriously affect the ability of ICO to reach its primary market, customers in unserved and underserved areas of the United States.

ICO and Eagle River are committed to meeting the Commission's stated goal of providing affordable service to unserved and underserved areas of the United States. Consumers in rural and remote areas are a primary market for 2 GHz MSS voice and data services. Indeed, it is Commission policy that satellite services - as distinct from terrestrial wireless services - focus on rural areas. Consequently, the Commission must not reflexively adopt the relocation compensation scheme developed for a terrestrial service like PCS in all its particulars. Instead, the Commission must apply the

2 *See* letter from Cheryl A. Tritt, Esq. to Magalie Roman Salas, IB Docket No. 99-81, ET Docket No. 95-18, RM-9328 at Chart 2 (Oct. 1, 1999).

principles it has used in the past sensibly in light of the ways in which satellite and terrestrial networks differ.

Unlike PCS, where remote and rural areas can be - and are in fact - ignored, satellite services must incur the costs to serve those areas. This includes, of course, the costs of clearing incumbents. Terrestrial services can simply choose not to clear incumbents from low-density areas. Satellite services, because they are designed to offer service everywhere, cannot. Thus the PCS relocation regime may be sustainable for PCS because relocation need only be paid for in high-density areas where the high volume of traffic can support the high costs of relocating the incumbents. It is not sustainable, however, for MSS because rural and remote users are not able to support the high cost of relocation. Application of the Commission's PCS reallocation rules to satellite services undermines the Commissions own policy goals for satellite services - by making deployment in rural and underserved areas cost-inefficient.

There are, of course, other reasons why an unreasonably costly relocation scheme is bad public policy -- not least of which is the fact that it would constitute a windfall to FS operators. At the extreme, such a significant relocation cost burden might actually prevent the ICO system from deploying at all.

Under these circumstances, it is important for the Commission to adhere to its stated policy goal of leaving incumbents no worse off, but also no better off, than before any relocation. As ICO has previously argued, this can be achieved by measuring relocation compensation according to the remaining useful life of the equipment that is being replaced – not the full replacement cost of brand new equipment. After all, replacement cost is the measure of how much it costs for the incumbent to operate for the *next* ten years. What the incumbent should be compensated for is the extent to which the relocation made it impossible to recover the initial investment in the equipment that is being replaced – *i.e.*, a value based on the remaining useful life of the equipment at the time it was taken out of service (for which the book value of the equipment would be a reasonable surrogate number). While this measure of relocation compensation might require the incumbent to make a capital investment that is somewhat greater than the amount received from the new entrant, that incremental capital investment would reflect the fact that the new equipment would be in many ways superior to the old equipment – with a longer expected useful life or greater functionality, for example.

ICO and Eagle River understand that resistance from terrestrial incumbents has left the Commission with an unpalatable choice between two measures of relocation

compensation – one of them efficient but unpopular with incumbents, and the other one charitable to incumbents, but so inefficient as to jeopardize the viability of the MSS industry. With the increased importance of data services to MSS network viability, the need to find an equitable and efficient resolution has become even more urgent. We look forward to working with the Commission and its staff to find ways in which the terrestrial relocation framework can be modified so as to permit the successful roll-out of MSS services to the many, many places within the United States that still lack any mobile voice service.

ICO and Eagle River appreciate the Commission's efforts to accommodate the competing concerns that the 2 GHz MSS relocation cost issue presents. ICO and Eagle River also recognize that the information in this letter comes late in the Commission's 2 GHz MSS proceeding. For these reasons, ICO and Eagle River wished to bring these developments to the Commission's attention as soon as possible, in the hope that the Commission's ongoing consideration of the relocation cost problem will take them into account.

Respectfully submitted,

R. Gerard Salemme
R. Gerard Salemme CAT
Eagle River Investments, L.L.C.

Cheryl A. Tritt
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Counsel to ICO Global Communications

Attachment

cc: Adam Krinsky

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Figure 1depicts the geometry associated with the FS interfering directly into the ICO UT. The magnitude of interference will be related to the distance from the FS transmitter and the angular separation from the FS antenna boresight. By specifying an external interference allowance threshold, a boundary can be generated around the FS transmitter identifying a "keep-out" zone (a.k.a. exclusion zone).

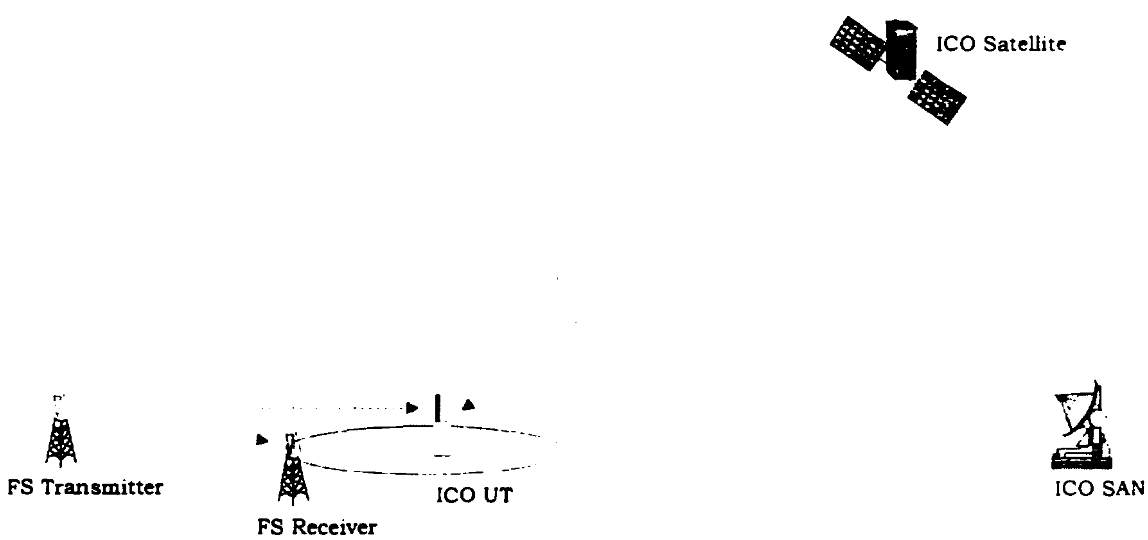
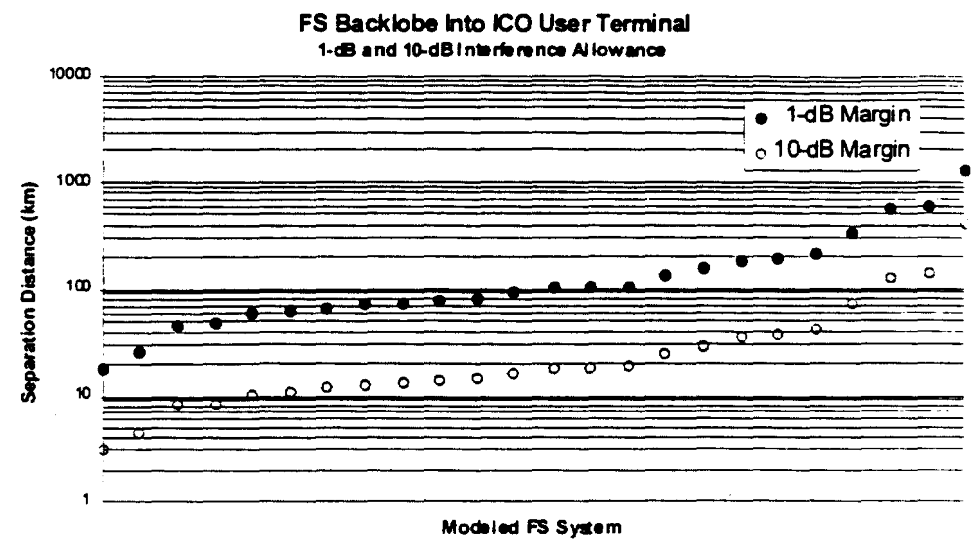


Figure 1. FS Interference into ICO UT (2170-2200 MHz Frequency Band)

Separation distances that would be required for the protection of an ICO user terminal (UT) from terrestrial station are given in Figure 2. In this analysis, parameters from the twenty-four 1.7-2.45 GHz FS systems summarized in Recommendation ITU-R F.758-1 were used. These parameters, which are provided in Appendix A, represent three types of FS systems - traditional point-to-point, land-mobile and troposcatter. For each of the 24 carriers, two distances are computed: one assuming that the interference to the UT should not exceed 6% long-term allowance (1 dB) and the other assuming that the interference can degrade the link margin by 10 dB. Again note that the UT is assumed to be located in the back-lobe of the terrestrial station. As shown in the figure, the majority of typical FS systems will create a minimum separation distance on the order of 60- to 200-km. Although such line-of-sight distances are unlikely to occur due to terrain blockages, it is clear that whenever the ICO UT sees an FS transmitter (independent of FS pointing direction), the UT will not be able to operate in the same frequency band.



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Capacity	625-line PAL	60-132 channels	94 channels		625-line PAL	960 channels	72-312 channels	2 Mbit/s	34 Mbit/s	8 Mbit/s	1-6 channels	48 channels	12.6 Mbit/s	600 channels	2 × 8 Mbit/s	1 TV + 2 Mbit/s	4 × 1.54 Mbit/s	45 Mbit/s	8 Mbit/s	2 × 8 Mbit/s
Channel spacing (MHz)	Variable	14/1	3.5		29	29	Special	Special	29	14	0.4	2.5	28	28	14	3.5	3.5	29	7	14
			CS	OS																
Antenna gain (maximum) (dBi)	25	31	10	19	34	34	49	45	31	30	25	29	30	35.7	28	32	32	33	28	28
Feeder/multiplexer loss (minimum) (dB)	0	5	3	3	5	3	2	2	1	3	3	6	3.5	3.5	4	6	3	3	5	5
Antenna type	1.2 m dish	2.4 m dish	Omni	Horn	3.7 m dish	3.7 m dish	12 m dish	9 m dish	1.8 m dish	1.2 m dish	Yagi	Dish	Dish	Dish	2.4 m dish	3 m dish	3 m dish	3 m dish	1.8 m dish	1.8 m dish
Maximum Tx output power (dBW)	7	7	4	4	10	7	28	30	3	0	10	-9	-10	-5.2	3	5	6	7	7	-3
e.i.r.p. (maximum) (dBW)	32	33	13	22	39	38	75	73	34	30	32	14	16.5	27	29	37	38	40	20	23
Receiver IF bandwidth (MHz)	30	2.8	2	2	40	40	6	1	20	4	0.15	1.5	6.5	20	8	3	3.5	29	3	4.6
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Nominal Rx input level (dBW)	-65	-79	-97	-97	-68	-64	–	-	-73	-78	-78	-78	-88.3	-78			-70	-75	-83	-83
Rx input level for 1 × 10^{-3} BER (dBW)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-131	-113	-118	N/A	-	–	N/A			-117	-112	-123	-123
Nominal short-term interference (dBW) (% time)																				
Nominal long-term interference (dBW)	-127	-143	-142	-142	-128	-129	-138	-146	-137	-143	-158				-137	-141	-139	-135	-141	-139
Equivalent power (dB(W/4 kHz))	–	-172	-169	-169	–	-169	-172	–	-	–	-174				-170	-170	-168	-174	–	–
Spectral density (dB(W/MHz))	-142	-	–	–	-144	–	–	-146	-150	-149	–	–			-146	–			-146	-146
Refer to Notes	(1), (4)	(2), (5)	(2), (5)	(2), (5)	(2), (4)	(2), (5)	(1), (5)	(1), (4)	(2), (4)	(2), (4)	(2), (5)	(3), (4)	(3), (4)	(3), (5)	(1), (4)		(1)	(1)	(1)	(1)

TVOB: temporary TV outside broadcast (ENG) link
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Capacity			45 Mbit/s	18.5 Mbit/s	48 channels	96 channels	252 channels	3.1 Mbit/s	6.2 Mbit/s	18.5 Mbit/s	17-312 channels	2 × 2 Mbit/s	34 Mbit/s	2.3 Mbit/s	625-line PAL
Channel spacing (MHz)	3.5		10	3.5	0.8	1.6	3.5	0.8	1.6	3.5	Special	14			Variable
	CS	OS													
Antenna gain (maximum) (dBi)	17	27	33	33	38	38	38	38	38	38	49	25	35.4		18
Feeder/multiplexer loss (minimum) (dB)	0	0	2	2	0	0	0	0	0	0	2	4			1
Antenna type	Omni/ section	Dish/horn	Dish	Dish	Dish	Dish	Dish	Dish	Dish	Dish	12 m dish	1.2 m dish	3 m dish	Yagi	Dish
Maximum Tx output power (dBW)	7	7	1	−1	+8	+8	+8	+2	+5	+2	28	5	−2		7
e.i.r.p. (maximum) (dBW)	24	34	34	32	46	46	46	40	43	40	75	26	33		32
Receiver IF bandwidth (MHz)	3.5	3.5	10	3.5	2.5	6.0	12.0	0.8	1.6	3.5	6	3			30
Receiver noise figure (dB)	3.5	3.5	4	4	5	5	5	3	3	3	2	4			6
Receiver thermal noise (dBW)	−135	−135	−130	−134.5	−140	−137	−134	−142	−139	−136	−132	−135			−123
Nominal Rx input level (dBW)	–	–	−65	−65	−60	−60	−60	−60	−60	−60	−65	–			−55
Rx input level for 1×10^{-3} BER (dBW)	–	–	−106	−104.5	−121	−118	−114	−117	−115	−105	N/A	–			N/A
Nominal short-term interference (dBW) (% time)															
Nominal long-term interference (dBW)	−141	−141	−136	−140.5	−150	−147	−144	−152	−149	−146	−138	−141	−111.5		−123
Equivalent power (dB(W/4 kHz))	−170	−170	−170	−170	−173	−173	−173				−172	−170			–
Spectral density (dB(W/MHz))	–	–	−146	−146				−151	−151	−151	–	−162			−129
Refer to Notes	(1)	(1)			(2), (4), (5)	(2), (4), (5)	(2), (4), (5)	(2), (4)	(2), (4)	(2), (4)	(1), (5)				

CS: central station

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March 2, 2000

Commissioner Harold W. Furchtgott-Roth
Federal Communications Commission
The Portals
445 12th Street, S.W., Room 8-A302
Washington, D.C. 20554

Re: **EX PARTE**
IB Docket No. 99-81; ET Docket No. 95-18, RM-9328

Dear Commissioner Furchtgott-Roth:

As the Commission previously has been advised, the United States Bankruptcy Court for the District of Delaware granted final approval to an agreement reached on October 31, 1999 (the "Agreement") under which Craig McCaw and his affiliated companies, Teledesic LLC and Eagle River Investments LLC, will provide a total investment of up to $1.2 billion to fund the planned build-out of the ICO mobile satellite service ("MSS") system and provide working capital through the launch of ICO's MSS satellites.[1] In the process of bankruptcy restructuring, ICO and Eagle River have determined that a broader range of services and technological applications will be essential to the success of the ICO MSS system. Specifically, the addition of a set of high-quality wireless data applications that will be accessible through ICO customers' handsets is critical to ensuring that satellite service is a viable commercial service and quite possibly the only alternative communication system for rural and other unserved areas.

Unfortunately, as the attached analysis illustrates, the addition of the new data services to the ICO system will further constrain that system's ability to share with terrestrial Fixed Service (FS) incumbents in the 2 GHz MSS downlink band. As the attached technical analysis demonstrates, whenever an ICO user terminal (UT) is within

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the radio horizon of an FS transmitter, the UT will be unable to operate on the frequencies occupied by the local FS transmitter. The new data service requires the use of wider signals and lower error rates, making the ICO system less tolerant of interference from terrestrial Fixed Service ("FS") systems and less able to avoid such interference. Specifically, techniques that could be applied to reduce the probability that a voice channel assigned to a UT would overlap the frequencies used by local FS microwave transmitters, become increasingly less effective as higher bandwidth services become predominate. Moreover, data services will load the ICO system's capacity more rapidly than voice service and will prevent ICO from reserving alternative, interference-free frequencies required to allow sharing with FS incumbents. Accordingly, in order for ICO to meet anticipated demand for its wireless mobile wideband data service at an acceptable level of quality, additional clearing will be required in the downlink and will be substantially in excess of the estimates the Commission has made so far.

ICO and Eagle River note that it is the present policy of the FCC to require 2 GHz MSS systems to compensate terrestrial incumbents for relocation costs in order to ameliorate any operational disruption or financial hardship. However, ICO has consistently maintained, even under its more modest plan for voice services, that unreasonable compensation measures for relocating terrestrial incumbents would impair the ability of 2 GHz MSS systems to move forward. For example, as ICO pointed out in a recent presentation to the Commission, $200 million of relocation costs imposed upon MSS providers in the U.S. likely would increase the per-minute cost of 2 GHz MSS service by 83 cents.[2] Certainly the need to reflect these substantial added costs in end-user rates will seriously affect the ability of ICO to reach its primary market, customers in unserved and underserved areas of the United States.

ICO and Eagle River are committed to meeting the Commission's stated goal of providing affordable service to unserved and underserved areas of the United States. Consumers in rural and remote areas are a primary market for 2 GHz MSS voice and data services. Indeed, it is Commission policy that satellite services - as distinct from terrestrial wireless services - focus on rural areas. Consequently, the Commission must not reflexively adopt the relocation compensation scheme developed for a terrestrial service like PCS in all its particulars. Instead, the Commission must apply the

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principles it has used in the past sensibly in light of the ways in which satellite and terrestrial networks differ.

Unlike PCS, where remote and rural areas can be - and are in fact - ignored, satellite services must incur the costs to serve those areas. This includes, of course, the costs of clearing incumbents. Terrestrial services can simply choose not to clear incumbents from low-density areas. Satellite services, because they are designed to offer service everywhere, cannot. Thus the PCS relocation regime may be sustainable for PCS because relocation need only be paid for in high-density areas where the high volume of traffic can support the high costs of relocating the incumbents. It is not sustainable, however, for MSS because rural and remote users are not able to support the high cost of relocation. Application of the Commission's PCS reallocation rules to satellite services undermines the Commissions own policy goals for satellite services - by making deployment in rural and underserved areas cost-inefficient.

There are, of course, other reasons why an unreasonably costly relocation scheme is bad public policy -- not least of which is the fact that it would constitute a windfall to FS operators. At the extreme, such a significant relocation cost burden might actually prevent the ICO system from deploying at all.

Under these circumstances, it is important for the Commission to adhere to its stated policy goal of leaving incumbents no worse off, but also no better off, than before any relocation. As ICO has previously argued, this can be achieved by measuring relocation compensation according to the remaining useful life of the equipment that is being replaced – not the full replacement cost of brand new equipment. After all, replacement cost is the measure of how much it costs for the incumbent to operate for the *next* ten years. What the incumbent should be compensated for is the extent to which the relocation made it impossible to recover the initial investment in the equipment that is being replaced – *i.e.*, a value based on the remaining useful life of the equipment at the time it was taken out of service (for which the book value of the equipment would be a reasonable surrogate number). While this measure of relocation compensation might require the incumbent to make a capital investment that is somewhat greater than the amount received from the new entrant, that incremental capital investment would reflect the fact that the new equipment would be in many ways superior to the old equipment – with a longer expected useful life or greater functionality, for example.

ICO and Eagle River understand that resistance from terrestrial incumbents has left the Commission with an unpalatable choice between two measures of relocation

compensation – one of them efficient but unpopular with incumbents, and the other one charitable to incumbents, but so inefficient as to jeopardize the viability of the MSS industry. With the increased importance of data services to MSS network viability, the need to find an equitable and efficient resolution has become even more urgent. We look forward to working with the Commission and its staff to find ways in which the terrestrial relocation framework can be modified so as to permit the successful roll-out of MSS services to the many, many places within the United States that still lack any mobile voice service.

ICO and Eagle River appreciate the Commission's efforts to accommodate the competing concerns that the 2 GHz MSS relocation cost issue presents. ICO and Eagle River also recognize that the information in this letter comes late in the Commission's 2 GHz MSS proceeding. For these reasons, ICO and Eagle River wished to bring these developments to the Commission's attention as soon as possible, in the hope that the Commission's ongoing consideration of the relocation cost problem will take them into account.

Respectfully submitted,

R. Gerard Salemme

R. Gerard Salemme CAT
Eagle River Investments, L.L.C.

Cheryl A. Tritt

Cheryl A. Tritt
Counsel to ICO Global Communications

Attachment

cc: Bryan Tramont

FS Interference Into ICO User Terminals at 2 GHz

Introduction

This report presents an analysis relating to terrestrial Fixed Service (FS) systems and ICO NGSO/MSS co-frequency operation in the 2-GHz downlink band (2170 - 2200 MHz). The results indicate that whenever an ICO user terminal (UT) is within the radio horizon of an FS transmitter, unacceptable interference levels will preclude that portion of frequency spectrum from ICO use.

The focus on improved *data* communications services by ICO means a different approach to sharing in the downlink with the FS. Data transmissions require the use of wider signals and significantly lower bit error rates, making the system less tolerant of FS interference, and less able to avoid it. The original concept for FS sharing was to carry alternative frequencies, one of which should be interference-free. Since satellite loading and spectrum uptake will increase faster with data than with a voice-oriented service, there will be reduced satellite resources that can be used to carry alternative frequencies for interference avoidance. ICO will be one of the main sources of wireless mobile wideband data, and users will expect a high quality of service in any location. This will require additional clearing in the 2 GHz downlink band, as high levels of interference will occur in the proximity (frequency and distance) of any FS transmitter.

Interference Scenario

Figure 1depicts the geometry associated with the FS interfering directly into the ICO UT. The magnitude of interference will be related to the distance from the FS transmitter and the angular separation from the FS antenna boresight. By specifying an external interference allowance threshold, a boundary can be generated around the FS transmitter identifying a "keep-out" zone (a.k.a. exclusion zone).

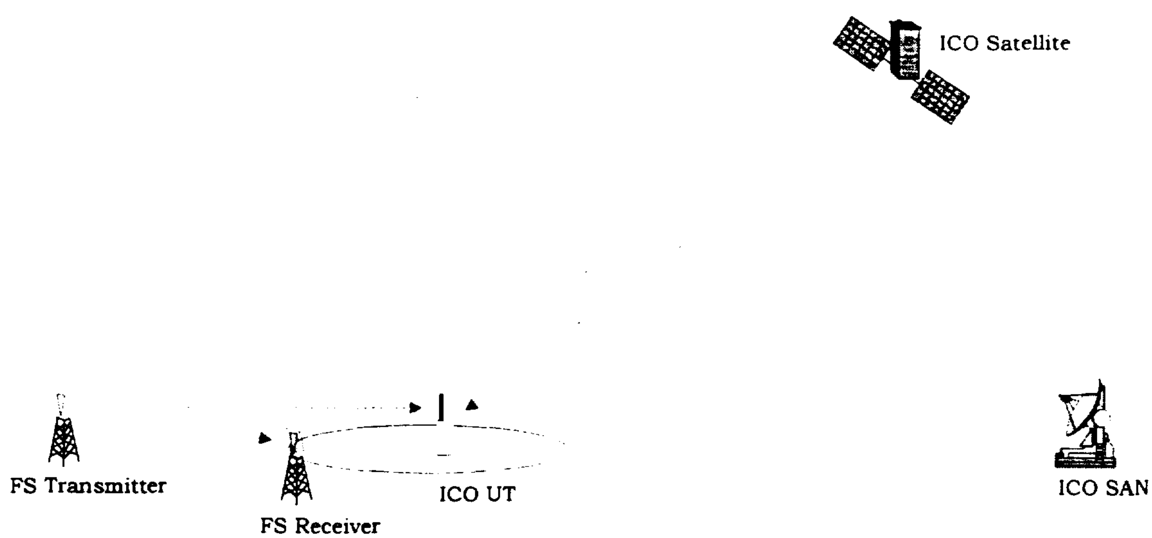

Figure 1. FS Interference into ICO UT (2170-2200 MHz Frequency Band)

Separation distances that would be required for the protection of an ICO user terminal (UT) from terrestrial station are given in Figure 2. In this analysis, parameters from the twenty-four 1.7-2.45 GHz FS systems summarized in Recommendation ITU-R F.758-1 were used. These parameters, which are provided in Appendix A, represent three types of FS systems - traditional point-to-point, land-mobile and troposcatter. For each of the 24 carriers, two distances are computed: one assuming that the interference to the UT should not exceed 6% long-term allowance (1 dB) and the other assuming that the interference can degrade the link margin by 10 dB. Again note that the UT is assumed to be located in the back-lobe of the terrestrial station. As shown in the figure, the majority of typical FS systems will create a minimum separation distance on the order of 60- to 200-km. Although such line-of-sight distances are unlikely to occur due to terrain blockages, it is clear that whenever the ICO UT sees an FS transmitter (independent of FS pointing direction), the UT will not be able to operate in the same frequency band.

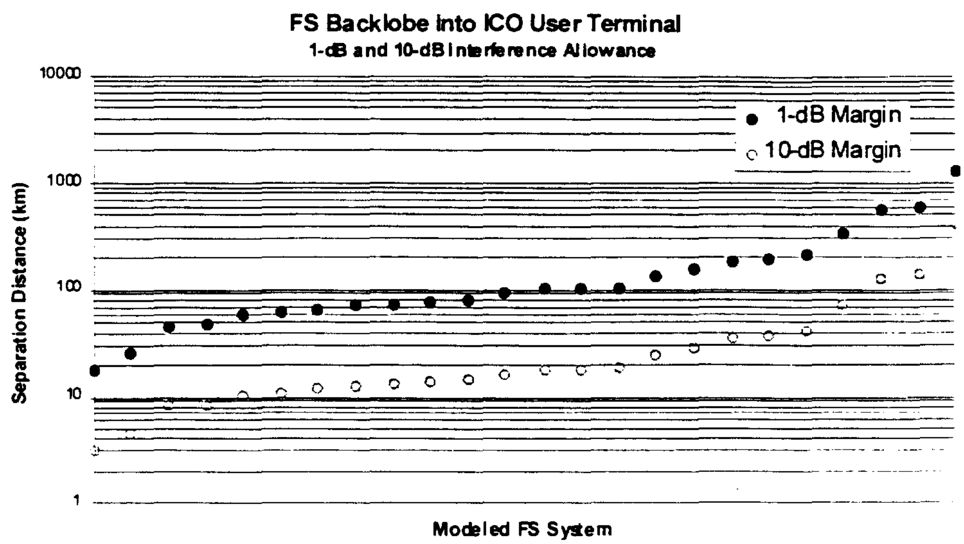

Figure 2. Separation Distances Required for the Protection of an ICO UT located in the Back-lobe of the Transmit Antenna of a Terrestrial Station.

A. FS System Parameters

Appendix A

FS System Parameters for FS Sharing Below 3 GHz (Rec. ITU-R F.758-1, Table 6)

Frequency band GHz)	1.7-2.45																			
Modulation	FM-TVOB	FM-FDM	FM-MLT-PT		FM-TV	FM-FDM	FM-FDM tropos	4-PSK tropos	4-PSK	4-PSK	FM-FDM	4-PSK	4-PSK	FM-FDM	4-PSK	FM-QAM	9-QRP	0-QPSK	4-PSK	4-PSK
Capacity	625-line PAL	60-132 channels	94 channels		625-line PAL	960 channels	72-312 channels	2 Mbit/s	34 Mbit/s	8 Mbit/s	1-6 channels	48 channels	12.6 Mbit/s	600 channels	2 × 8 Mbit/s	1 TV + 2 Mbit/s	4 × 1.54 Mbit/s	45 Mbit/s	8 Mbit/s	2 × 8 Mbit/s
Channel spacing (MHz)	Variable	14/1	3.5		29	29	Special	Special	29	14	0.4	2.5	28	28	14	3.5	3.5	29	7	14
			CS	OS																
Antenna gain (maximum) (dBi)	25	31	10	19	34	34	49	45	31	30	25	29	30	35.7	28	32	32	33	28	28
Feeder/multiplexer loss (minimum) (dB)	0	5	3	3	5	3	2	2	1	3	3	6	3.5	3.5	4	6	3	3	5	5
Antenna type	1.2 m dish	2.4 m dish	Omni	Horn	3.7 m dish	3.7 m dish	12 m dish	9 m dish	1.8 m dish	1.2 m dish	Yagi	Dish	Dish	Dish	2.4 m dish	3 m dish	3 m dish	3 m dish	1.8 m dish	1.8 m dish
Maximum Tx output power (dBW)	7	7	4	4	10	7	28	30	3	0	10	-9	-10	-5.2	3	5	6	7	7	-3
e.i.r.p. (maximum) (dBW)	32	33	13	22	39	38	75	73	34	30	32	14	16.5	27	29	37	38	40	20	23
Receiver IF bandwidth (MHz)	30	2.8	2	2	40	40	6	1	20	4	0.15	1.5	6.5	20	8	3	3.5	29	3	4.6
Receiver noise figure (dB)	8	7	9	9	10	10	2	4	4	5	4	6	9	10	4	4	5	4	4	4
Receiver thermal noise (dBW)	-121	-133	-132	-132	-118	-118	-132	-140	-127	-133	-148	–	–	-	-131	-135	-133	-125	-135	-133
Nominal Rx input level (dBW)	-65	-79	-97	-97	-68	-64	–	-	-73	-78	-78	-78	-88.3	-78			-70	-75	-83	-83
Rx input level for 1×10^{-3} BER (dBW)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-131	113	-118	N/A	-	–	N/A			-117	-112	-123	-123
Nominal short-term interference (dBW) (% time)																				
Nominal long-term interference (dBW)	-127	-143	-142	-142	-128	-129	-138	146	-137	-143	-158				-137	-141	-139	-135	-141	-139
Equivalent power (dB(W/4 kHz))	–	-172	-169	-169	-	-169	-172		-	–	-174				-170	-170	-168	-174	–	–
Spectral density (dB(W/MHz))	-142	–	–	–	-144	–	–	-146	-150	149	–	–			-146	-			-146	-146
Refer to Notes	(1), (4)	(2), (5)	(2), (5)	(2), (5)	(2), (4)	(2), (5)	(1), (5)	(1), (4)	(2), (4)	(2), (4)	(2), (5)	(3), (4)	(3), (4)	(3), (5)	(1), (4)		(1)	(1)	(1)	(1)

TVOB: temporary TV outside broadcast (ENG) link OS: out station

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(1) Specified interference will reduce system *C/N* by 1 dB (interference 6 dB below receiver thermal noise floor).

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(3) Specified interference will have a relative contribution of no more than 10% of total noise.

(4) The specified interference level is total power within the receiver bandwidth.

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FS System Parameters for FS Sharing Below 3 GHz (Rec. ITU-R F.758-1, Table 7)

Frequency band (GHz)	1.7-2.45				2.1-2.2						2.45-2.69				
Modulation	4-PSK		64-QAM	256-QAM	FDM-FM	FDM-FM	FDM-FM	32 TCM	64-QAM	256-QAM	FM-FDM tropos	MSK	4-PSK	4-PSK	FM-TVOB
Capacity			45 Mbit/s	18.5 Mbit/s	48 channels	96 channels	252 channels	3.1 Mbit/s	6.2 Mbit/s	18.5 Mbit/s	17-312 channels	2 × 2 Mbit/s	34 Mbit/s	2.3 Mbit/s	625-line PAL
Channel spacing (MHz)	3.5		10	3.5	0.8	1.6	3.5	0.8	1.6	3.5	Special	14			Variable
	CS	OS													
Antenna gain (maximum) (dBi)	17	27	33	33	38	38	38	38	38	38	49	25	35.4		18
Feeder/multiplexer loss (minimum) (dB)	0	0	2	2	0	0	0	0	0	0	2	4			1
Antenna type	Omni/ section	Dish/horn	Dish	Dish	Dish	Dish	Dish	Dish	Dish	Dish	12 m dish	1.2 m dish	3 m dish	Yagi	Dish
Maximum Tx output power (dBW)	7	7	1	−1	+8	+8	+8	+2	+5	+2	28	5	−2		7
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Receiver IF bandwidth (MHz)	3.5	3.5	10	3.5	2.5	6.0	12.0	0.8	1.6	3.5	6	3			30
Receiver noise figure (dB)	3.5	3.5	4	4	5	5	5	3	3	3	2	4			6
Receiver thermal noise (dBW)	−135	−135	−130	−134.5	−140	−137	−134	−142	−139	−136	−132	−135			−123
Nominal Rx input level (dBW)	–	–	−65	−65	−60	−60	−60	−60	−60	−60	−65	–			−55
Rx input level for 1×10^{-3} BER (dBW)	–	–	−106	−104.5	−121	−118	−114	−117	−115	−105	N/A	–			N/A
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Spectral density (dB(W/MHz))	–	–	−146	−146				−151	−151	−151	–	−162			−129
Refer to Notes	(1)	(1)			(2), (4), (5)	(2), (4), (5)	(2), (4), (5)	(2), (4)	(2), (4)	(2), (4)	(1), (5)				

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March 2, 2000

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Unlike PCS, where remote and rural areas can be - and are in fact - ignored, satellite services must incur the costs to serve those areas. This includes, of course, the costs of clearing incumbents. Terrestrial services can simply choose not to clear incumbents from low-density areas. Satellite services, because they are designed to offer service everywhere, cannot. Thus the PCS relocation regime may be sustainable for PCS because relocation need only be paid for in high-density areas where the high volume of traffic can support the high costs of relocating the incumbents. It is not sustainable, however, for MSS because rural and remote users are not able to support the high cost of relocation. Application of the Commission's PCS reallocation rules to satellite services undermines the Commissions own policy goals for satellite services - by making deployment in rural and underserved areas cost-inefficient.

There are, of course, other reasons why an unreasonably costly relocation scheme is bad public policy -- not least of which is the fact that it would constitute a windfall to FS operators. At the extreme, such a significant relocation cost burden might actually prevent the ICO system from deploying at all.

Under these circumstances, it is important for the Commission to adhere to its stated policy goal of leaving incumbents no worse off, but also no better off, than before any relocation. As ICO has previously argued, this can be achieved by measuring relocation compensation according to the remaining useful life of the equipment that is being replaced – not the full replacement cost of brand new equipment. After all, replacement cost is the measure of how much it costs for the incumbent to operate for the *next* ten years. What the incumbent should be compensated for is the extent to which the relocation made it impossible to recover the initial investment in the equipment that is being replaced – *i.e.,* a value based on the remaining useful life of the equipment at the time it was taken out of service (for which the book value of the equipment would be a reasonable surrogate number). While this measure of relocation compensation might require the incumbent to make a capital investment that is somewhat greater than the amount received from the new entrant, that incremental capital investment would reflect the fact that the new equipment would be in many ways superior to the old equipment – with a longer expected useful life or greater functionality, for example.

ICO and Eagle River understand that resistance from terrestrial incumbents has left the Commission with an unpalatable choice between two measures of relocation

compensation – one of them efficient but unpopular with incumbents, and the other one charitable to incumbents, but so inefficient as to jeopardize the viability of the MSS industry. With the increased importance of data services to MSS network viability, the need to find an equitable and efficient resolution has become even more urgent. We look forward to working with the Commission and its staff to find ways in which the terrestrial relocation framework can be modified so as to permit the successful roll-out of MSS services to the many, many places within the United States that still lack any mobile voice service.

ICO and Eagle River appreciate the Commission's efforts to accommodate the competing concerns that the 2 GHz MSS relocation cost issue presents. ICO and Eagle River also recognize that the information in this letter comes late in the Commission's 2 GHz MSS proceeding. For these reasons, ICO and Eagle River wished to bring these developments to the Commission's attention as soon as possible, in the hope that the Commission's ongoing consideration of the relocation cost problem will take them into account.

Respectfully submitted,

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Eagle River Investments, L.L.C.

Cheryl A. Tritt
Counsel to ICO Global Communications

Attachment

cc: Peter Tenhula

FS Interference Into ICO User Terminals at 2 GHz

Introduction

This report presents an analysis relating to terrestrial Fixed Service (FS) systems and ICO NGSO/MSS co-frequency operation in the 2-GHz downlink band (2170 - 2200 MHz). The results indicate that whenever an ICO user terminal (UT) is within the radio horizon of an FS transmitter, unacceptable interference levels will preclude that portion of frequency spectrum from ICO use.

The focus on improved *data* communications services by ICO means a different approach to sharing in the downlink with the FS. Data transmissions require the use of wider signals and significantly lower bit error rates, making the system less tolerant of FS interference, and less able to avoid it. The original concept for FS sharing was to carry alternative frequencies, one of which should be interference-free. Since satellite loading and spectrum uptake will increase faster with data than with a voice-oriented service, there will be reduced satellite resources that can be used to carry alternative frequencies for interference avoidance. ICO will be one of the main sources of wireless mobile wideband data, and users will expect a high quality of service in any location. This will require additional clearing in the 2 GHz downlink band, as high levels of interference will occur in the proximity (frequency and distance) of any FS transmitter.

Interference Scenario

Figure 1depicts the geometry associated with the FS interfering directly into the ICO UT. The magnitude of interference will be related to the distance from the FS transmitter and the angular separation from the FS antenna boresight. By specifying an external interference allowance threshold, a boundary can be generated around the FS transmitter identifying a "keep-out" zone (a.k.a. exclusion zone).

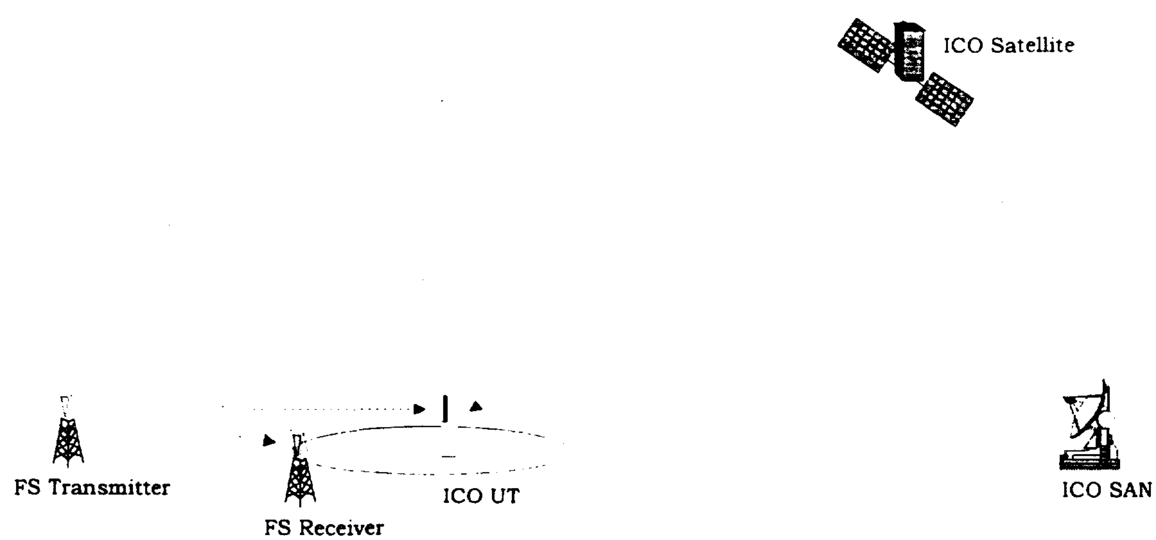

Figure 1. FS Interference into ICO UT (2170-2200 MHz Frequency Band)

Separation distances that would be required for the protection of an ICO user terminal (UT) from terrestrial station are given in Figure 2. In this analysis, parameters from the twenty-four 1.7-2.45 GHz FS systems summarized in Recommendation ITU-R F.758-1 were used. These parameters, which are provided in Appendix A, represent three types of FS systems - traditional point-to-point, land-mobile and troposcatter. For each of the 24 carriers, two distances are computed: one assuming that the interference to the UT should not exceed 6% long-term allowance (1 dB) and the other assuming that the interference can degrade the link margin by 10 dB. Again note that the UT is assumed to be located in the back-lobe of the terrestrial station. As shown in the figure, the majority of typical FS systems will create a minimum separation distance on the order of 60- to 200-km. Although such line-of-sight distances are unlikely to occur due to terrain blockages, it is clear that whenever the ICO UT sees an FS transmitter (independent of FS pointing direction), the UT will not be able to operate in the same frequency band.

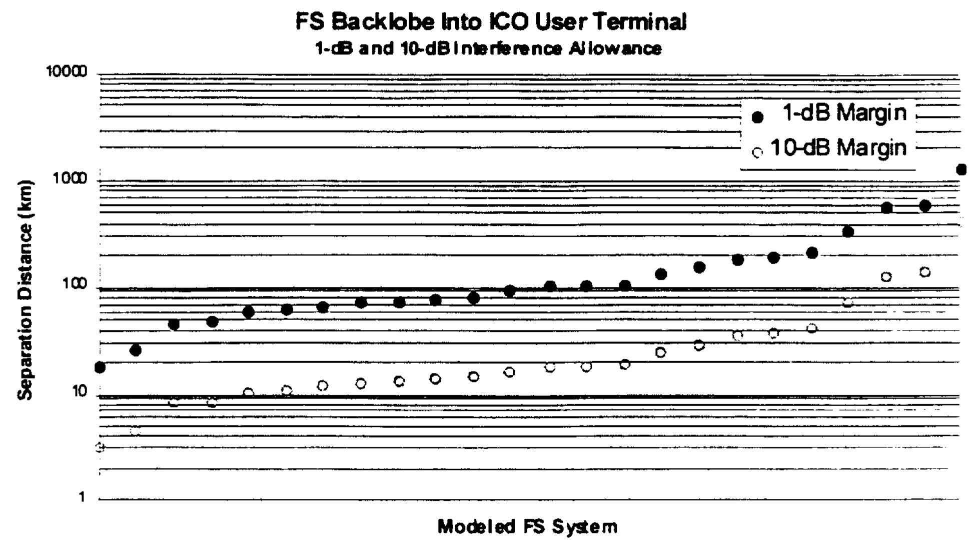

Figure 2. Separation Distances Required for the Protection of an ICO UT located in the Back-lobe of the Transmit Antenna of a Terrestrial Station.

A. FS System Parameters

Appendix A

FS System Parameters for FS Sharing Below 3 GHz (Rec. ITU-R F.758-1, Table 6)

Frequency band GHz)	1.7-2.45																			
Modulation	FM-TVOB	FM-FDM	FM-MLT-PT		FM-TV	FM-FDM	FM-FDM tropos	4-PSK tropos	4-PSK	4-PSK	FM-FDM	4-PSK	4-PSK	FM-FDM	4-PSK	FM-QAM	9-QRP	0-QPSK	4-PSK	4-PSK
Capacity	625-line PAL	60-132 channels	94 channels		625-line PAL	960 channels	72-312 channels	2 Mbit/s	34 Mbit/s	8 Mbit/s	1-6 channels	48 channels	12.6 Mbit/s	600 channels	2 × 8 Mbit/s	1 TV + 2 Mbit/s	4 × 1.54 Mbit/s	45 Mbit/s	8 Mbit/s	2 × 8 Mbit/s
Channel spacing (MHz)	Variable	14/1	3.5		29	29	Special	Special	29	14	0.4	2.5	28	28	14	3.5	3.5	29	7	14
			CS	OS																
Antenna gain (maximum) (dBi)	25	31	10	19	34	34	49	45	31	30	25	29	30	35.7	28	32	32	33	28	28
Feeder/multiplexer loss (minimum) (dB)	0	5	3	3	5	3	2	2	1	3	3	6	3.5	3.5	4	6	3	3	5	5
Antenna type	1.2 m dish	2.4 m dish	Omni	Horn	3.7 m dish	3.7 m dish	12 m dish	9 m dish	1.8 m dish	1.2 m dish	Yagi	Dish	Dish	Dish	2.4 m dish	3 m dish	3 m dish	3 m dish	1.8 m dish	1.8 m dish
Maximum Tx output power (dBW)	7	7	4	4	10	7	28	30	3	0	10	-9	10	-5.2	3	5	6	7	7	-3
e.i.r.p. (maximum) (dBW)	32	33	13	22	39	38	75	73	34	30	32	14	16.5	27	29	37	38	40	20	23
Receiver IF bandwidth (MHz)	30	2.8	2	2	40	40	6	1	20	4	0.15	1.5	6.5	20	8	3	3.5	29	3	4.6
Receiver noise figure (dB)	8	7	9	9	10	10	2	4	4	5	4	6	9	10	4	4	5	4	4	4
Receiver thermal noise (dBW)	-121	-133	-132	-132	-118	-118	-132	-140	-127	-133	-148	–	–	–	-131	-135	-133	-125	-135	-133
Nominal Rx input level (dBW)	-65	-79	-97	-97	-68	-64	–	-	-73	-78	-78	-78	-88.3	-78			-70	-75	-83	-83
Rx input level for 1×10^{-3} BER (dBW)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-131	-113	-118	N/A	–	–	N/A			-117	-112	-123	-123
Nominal short-term interference (dBW) (% time)																				
Nominal long-term interference (dBW)	-127	-143	-142	-142	128	129	-138	-146	137	-143	-158				-137	141	-139	-135	-141	-139
Equivalent power (dB(W/4 kHz))	–	-172	-169	-169	–	-169	-172	–	-	–	-174				-170	-170	-168	-174	–	–
Spectral density (dB(W/MHz))	-142	–	–	–	-144	–	–	-146	-150	-149	–	–			-146	–			-146	-146
Refer to Notes	(1), (4)	(2), (5)	(2), (5)	(2), (5)	(2), (4)	(2), (5)	(1), (5)	(1), (4)	(2), (4)	(2), (4)	(2), (5)	(3), (4)	(3), (4)	(3), (5)	(1), (4)		(1)	(1)	(1)	(1)

TVOB: temporary TV outside broadcast (ENG) link — OS: out station

CS: central station — N/A: not applicable

(1) Specified interference will reduce system *C/N* by 1 dB (interference 6 dB below receiver thermal noise floor).

(2) Specified interference will reduce system *C/N* by 0.5 dB (interference 10 dB below receiver thermal noise floor).

(3) Specified interference will have a relative contribution of no more than 10% of total noise.

(4) The specified interference level is total power within the receiver bandwidth.

(5) The specified interference level should be divided by the receiver bandwidth to obtain an average spectral density. The interference spectral density, averaged over any 4 kHz within the receiver bandwidth, must not exceed this value.

FS System Parameters for FS Sharing Below 3 GHz (Rec. ITU-R F.758-1, Table 7)

Frequency band (GHz)	1.7-2.45				2.1-2.2						2.45-2.69				
Modulation	4-PSK		64-QAM	256-QAM	FDM-FM	FDM-FM	FDM-FM	32 TCM	64-QAM	256-QAM	FM-FDM tropos	MSK	4-PSK	4-PSK	FM-TVOB
Capacity			45 Mbit/s	18.5 Mbit/s	48 channels	96 channels	252 channels	3.1 Mbit/s	6.2 Mbit/s	18.5 Mbit/s	17-312 channels	2 × 2 Mbit/s	34 Mbit/s	2.3 Mbit/s	625-line PAL
Channel spacing (MHz)	3.5		10	3.5	0.8	1.6	3.5	0.8	1.6	3.5	Special	14			Variable
	CS	OS													
Antenna gain (maximum) (dBi)	17	27	33	33	38	38	38	38	38	38	49	25	35.4		18
Feeder/multiplexer loss (minimum) (dB)	0	0	2	2	0	0	0	0	0	0	2	4			1
Antenna type	Omni/ section	Dish/horn	Dish	Dish	Dish	Dish	Dish	Dish	Dish	Dish	12 m dish	1.2 m dish	3 m dish	Yagi	Dish
Maximum Tx output power (dBW)	7	7	1	−1	+8	+8	+8	+2	+5	+2	28	5	−2		7
e.i.r.p. (maximum) (dBW)	24	34	34	32	46	46	46	40	43	40	75	26	33		32
Receiver IF bandwidth (MHz)	3.5	3.5	10	3.5	2.5	6.0	12.0	0.8	1.6	3.5	6	3			30
Receiver noise figure (dB)	3.5	3.5	4	4	5	5	5	3	3	3	2	4			6
Receiver thermal noise (dBW)	−135	−135	−130	−134.5	−140	−137	−134	−142	−139	−136	−132	−135			−123
Nominal Rx input level (dBW)	–	–	−65	−65	−60	−60	−60	−60	−60	−60	−65	–			−55
Rx input level for 1×10^{-3} BER (dBW)	–	–	−106	−104.5	−121	−118	−114	−117	−115	−105	N/A	–			N/A
Nominal short-term interference (dBW) (% time)															
Nominal long-term interference (dBW)	−141	−141	−136	−140.5	−150	−147	−144	−152	−149	−146	−138	−141	−111.5		−123
Equivalent power (dB(W/4 kHz))	−170	−170	−170	−170	−173	−173	−173				−172	−170			–
Spectral density (dB(W/MHz))	–	–	−146	−146				−151	−151	−151	–	−162			−129
Refer to Notes	(1)	(1)			(2), (4), (5)	(2), (4), (5)	(2), (4), (5)	(2), (4)	(2), (4)	(2), (4)	(1), (5)				

CS: central station
OS: out station
N/A: not applicable
TVOB: temporary TV outside broadcast (ENG) link

(1) Specified interference will reduce system *C/N* by 1 dB (interference 6 dB below receiver thermal noise floor).
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(4) The specified interference level is total power within the receiver bandwidth.
(5) The specified interference level should be divided by the receiver bandwidth to obtain an average spectral density. The interference spectral density, averaged over any 4 kHz within the receiver bandwidth, must not exceed this value.